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EXAMINER	
ALHIJA, SAIF A	

ART UNIT	PAPER NUMBER
2128	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/586,283	GHORAYEB ET AL.	
	Examiner	Art Unit	
	SAIF A. ALHIJA	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 August 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 6-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 July 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-4 and 6-20 have been presented for examination.

Claim 5 has been cancelled.

Claims 9-20 are newly presented.

Response to Arguments

2. Applicant's arguments filed 2 August 2010 have been fully considered but they are not persuasive.

PRIOR ART ARGUMENTS

i) Applicants argue that the Scott reference does not disclose "providing an open message-passing interface that communicates with black oil model reservoir simulations, compositional model reservoir simulations, and different types of surface networks." The Examiner notes that the Scott reference clearly recites the use of black oil and compositional simulations in the cited section of Page 4 below as well as at least in the abstract reciting the use of black oil and compositional fluid models. Further as per page 3 first full paragraph the system of the reference utilizes message passing over the network of nodes representing distinct machines. Applicants argue that the system of Scott is older and represents a single simulator and not multiple simulators in communication. The Examiner notes that Page 2 of the reference last line of the Parallel computing section recites that one of the options of parallel computing is MIMD whereby a collection of independent systems is connected by a network or via a shared memory that allows all of the processors to work together on a single problem. This in combination with the recitations of H, B, and W which reads on the claims recited and therefore the prior art rejection is **MAINTAINED**.

ii) Applicants further argue that the Scott reference does not disclose "each synchronization step enabling different simulation tasks to take non-identical time steps, wherein each simulation task of the first reservoir simulation and the second reservoir simulation advances independently to the next synchronization step using corresponding time steps and Newton iterations uniquely suited to the individual simulation task." The Examiner notes that the first full paragraph of Scott on page 3 recites synchronous messages being routed automatically by the system and further the use of multiple machines as argued above. Further the Examiner notes that the reference clearly recites the parallel computing with respect to time and Newton iterations as can be seen in page 5 right column third paragraph which recites **"Another application of parallel computations is in the forming of matrix coefficients for composition reservoir simulators. Fully implicit compositional fluid models**

are highly non-linear and are <u>often solved through use of a Newton-Raphson method</u> [10,17,18]. Phase equilibrium and fluid property calculations are repeatedly applied in the updating of matrix coefficients. Since these calculations are independent for every grid block, <u>this is an ideal application for the divide and conquer method.</u> Pipelining of the formation of matrix coefficients and matrix solution steps could also be performed." Further with respect to non-identical time steps the Examiner notes the recitation of synchronization implying non-identical time steps as well as the asynchronous message routing as recited in page 3 first full paragraph. The Examiner notes that the Scott reference is clear in its goal of utilizing parallel computing with synchronous and asynchronous messaging as per the claim language and further that it would have been obvious to utilize these features in parallel computing in order to describe a faster and increased quality method of simulation of hydrocarbon reservoirs. The Examiners arguments regarding a single simulation rather than multiple simulation as recited in Scott is incorrect as per the citations provided specifically with respect to the entire approach of Scott reciting the use of and benefits of parallel computing over multiple machines. This in combination with the recitations of H, B, and W which reads on the claims recited and therefore the prior art rejection is **MAINTAINED**.

<u>PRIORITY</u>

3. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). Priority date is 23 November 2002.

<u>Claim Rejections - 35 USC § 103</u>

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(c), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claim(s) 1-4 and 6-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Haugen et al. "Simulation of Independent Reservoirs Coupled by Global Production and Injection Constraints", hereafter H** in view of **Briens et al. "Application of Sequential Staging of Tasks to Petroleum Reservoir Modeling", hereafter B** further in view of **Watts U.S. Patent No. 6108608, hereafter W** further in view of **Scott et al. "Application of Parallel (MIMD) Computers to Reservoir Simulation", hereafter Scott.**

Regarding Claim 1:

H discloses A method of controlling the coupling of multiplatform reservoir and network simulators comprising:

initiating a first reservoir simulation for one or more physical parameters of a first reservoir in a first reservoir simulator, the first reservoir simulation using a first fluid model; **(H. "An oil or gas field may comprise a number of isolated reservoir units, each of which may have been studied separately with their own simulation models" as well as "The individual simulation models are still run as separate processes…")**

initiating a second reservoir simulation for the one or more physical parameters in a second reservoir in a second reservoir simulator, the second reservoir simulation using a second fluid model; **(H. "An oil or gas field may comprise a number of isolated reservoir units, each of which may have been studied separately with their own simulation models" as well as "The individual simulation models are still run as separate processes…")**

H does not disclose however B discloses, excluding the first and second reservoir aspect which is recited in H above, applying synchronization steps to the advancement through time of the first reservoir simulation executing on a first computing device and the second reservoir simulation executing on a second computing device **(B. Page 431, left column, second to last paragraph, "synchronization of parallel events")**

performing a production operation based on the first reservoir simulation of the first reservoir simulator and the second reservoir simulation of the second reservoir simulator the first reservoir simulator performed on the first computing device and the second simulation performed on the second computing device using the converted hydrocarbon fluid streams. **(B. Page 428, top right, production rates. Equation 1) (B. Introduction, paragraph 1, hydrocarbon and non-hydrocarbon components)**

B does not disclose translating each of first hydrocarbon fluid stream of the first reservoir simulation and a second hydrocarbon fluid stream of the second reservoir simulation to a common fluid model of a controller by converting pseudo components of each of the first hydrocarbon fluid stream and the second hydrocarbon fluid stream to a super set of pseudocomponents used in the first reservoir simulator and the second reservoir simulator.

However W discloses, excluding the first and second reservoir aspect which is recited in H above, translating each of a plurality of hydrocarbon fluid streams to a common fluid model of a controller by converting pseudo components of each of the plurality of hydrocarbon fluid streams to a super set of pseudocomponents used in the reservoir and network simulators executing on a computer. **(W. Abstract)**

H, B, and W do not explicitly recite however Scott recites providing an open message-passing interface that communicates with black oil model reservoir simulations, compositional model reservoir simulations, and different types of surface networks; **(Scott. Figure 3, message passing)**

each synchronization step enabling different simulation tasks to take non-identical time steps, wherein each simulation task of the first reservoir simulation and the second reservoir simulation advances independently to the next synchronization step using corresponding time steps and Newton iterations uniquely suited to the individual simulation task; **(Scott. Page 4, Forming Matrix Coefficients, including the Newton-Raphson iteration as well as using both black oil and compositional simulators as well as page 2 Parallel computing for the synchronization aspect)**

It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the pseudocomponent aspect of multi component fluid flow as discussed in W for the multiple independent reservoir simulation of H as well as the synchronization and production operation in parallel simulation of B since first the pseudocomponent aspect of W is "particularly useful in estimating properties and/or behavior of fluids contained in hydrocarbon-bearing, subterranean formations or in hydrocarbon processing

facilities." (W. Column 1, Lines 13-16) and further the synchronization and production operations of B through parallel processing result in a substantial decrease in processing time as well as promoting good load balancing for the simulation. (B. Page 432, Conclusions) It would further have been obvious to utilize the message passing and synchronization aspects of Scott with the simulation of H, B, and W since Scott describes a faster and increased quality method of simulation utilizing parallel computing, (Scott Introduction, Paragraph 1)

Regarding Claim 2:

See rejection of claim 1.

Regarding Claim 3:

The reference discloses The controller of claim 2 additionally comprising means for balancing the coupled multiplatform reservoir simulators including means for apportioning global production and injection rates between simulation tasks of the first reservoir simulator and the second reservoir simulator. **(B. Page 428, top right, production/injection) (H. "But they are coupled to a master process which handles the global production and injection constraints...")**

Regarding Claim 4:

The reference discloses The controller of claim 3 additionally comprising means for balancing the coupled multiplatform reservoir simulators and surface networks including balancing the surface network with the global production and injection rates apportioned between the simulation tasks of the first reservoir simulator and the second reservoir simulator. **(B. Introduction, paragraph 2, flow/material balancing. Page 432, left column, last two paragraphs, load balancing)**

Regarding Claim 6:

The reference discloses The controller of claim 2, wherein the means for initiating the first reservoir simulation initiates a first reservoir simulation that comprises a black oil model in the first reservoir simulator and

the means for initiating the second reservoir simulation initiates a second reservoir simulation that comprises a compositional model in the second reservoir simulator. **(Scott. Page 4, Forming Matrix Coefficients, both black oil and compositional simulators)**

Regarding Claim 7:

The reference discloses The controller of claim 2, further comprising means for coupling additional multi-platform reservoir simulators in addition to the first reservoir simulator and the second reservoir simulator, wherein the additional multi-platform reservoir simulators run a mixture of black oil models with different sets of active phases and compositional models with different sets of pseudo-components. **(Phases can be seen in Scott, Abstract, multiphase case using black oil and compositional fluid models and the pseudo component aspect is taught in W and cited above)**

Regarding Claim 8:

The reference discloses The controller of claim 2, wherein the first reservoir simulator and the second reservoir simulator run on different computer platforms. **(Scott, Abstract, Parallel computers)**

Regarding Claims 9-13:

See rejection of claims 3-4, and 6-8.

Regarding Claims 14-20:

See rejection of claims 1-4, and 6-8.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final

action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. All Claims are rejected.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to SAIF A. ALHIJA whose telephone number is (571)272-8635. The examiner can normally be reached on M-F, 11:00-7:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571) 272-2279. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. *Informal or draft communication, please label PROPOSED or DRAFT*, can be additionally sent to the Examiners fax phone number, (571) 273-8635.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Kamini S Shah/
Supervisory Patent Examiner, Art Unit 2128

SAA

October 9, 2010